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PECAN

. . . *an American wood*

Pecan is the name generally applied to the pecan hickories, a group consisting of four species—pecan, water hickory, nutmeg hickory, or bitternut hickory. The wood is rated as strong, stiff, very hard, heavy, and very high in shock resistance, although somewhat below the wood of the true hickories in strength and other mechanical properties. It is difficult to season, but can be dried successfully when proper procedures are followed. The major uses of the pecan hickories are furniture and flooring, as well as veneer for plywood paneling and containers.

FS–249
March 1973
U.S. Department of Agriculture
Forest Service

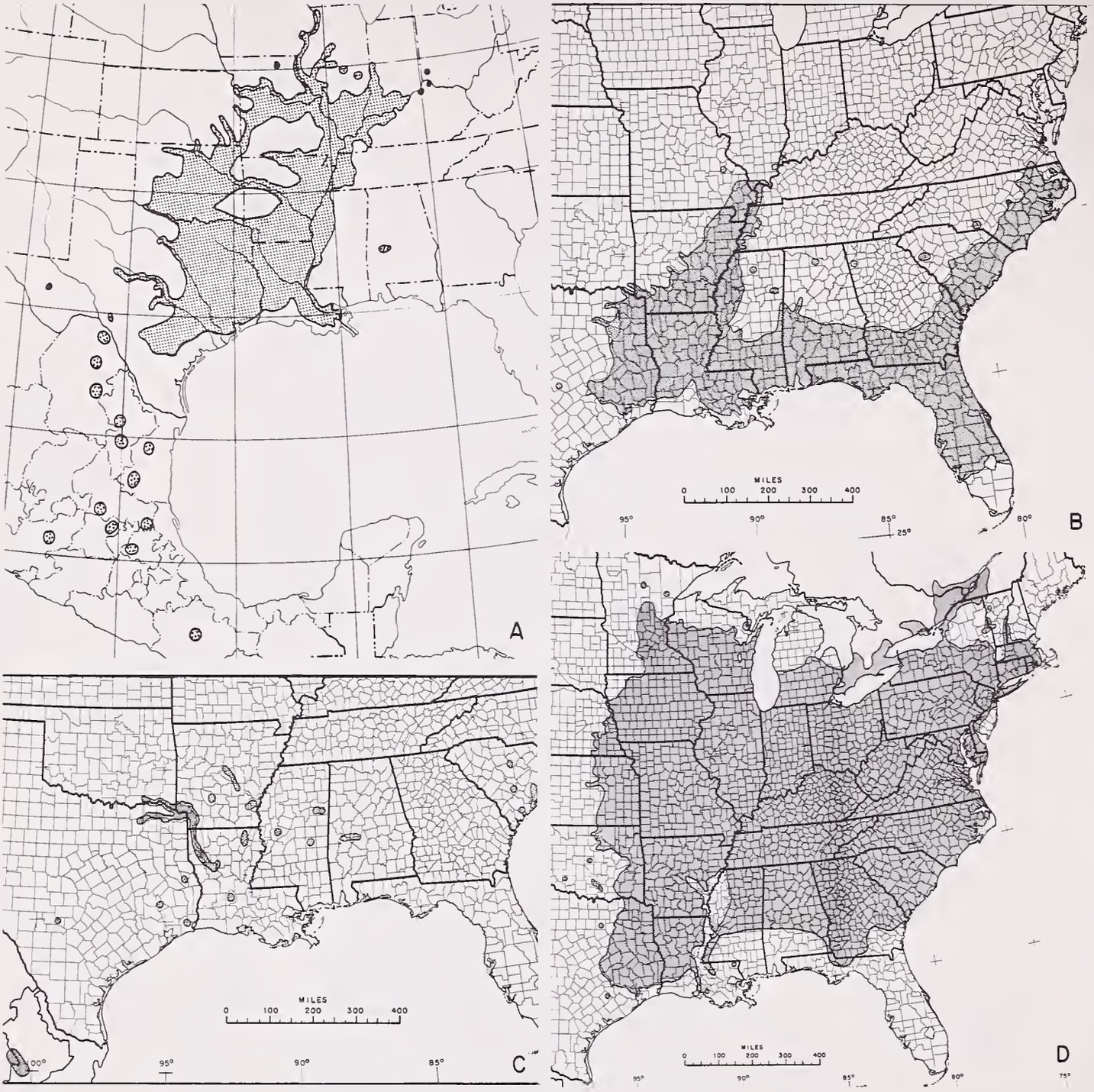

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Figure 1.—Natural range of pecan (A), water hickory (B), nutmeg hickory (C), bitternut hickory (D).

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PECAN
. . . *an American wood*

Alexander Clark III[1]

DISTRIBUTION

The pecan hickory group—pecan [*Carya illinoensis* (Wangenh.) K. Koch], water hickory [*Carya aquatica* (Michx. f.) Nutt.], nutmeg hickory [*Carya myristicaeformis* (Michx. f.) Nutt.], bitternut hickory [*Carya cordiformis* (Wangenh.) K. Koch]—is one of two groups into which the eight commercially important hickory species are classified. The pecan hickory group consists of pecan, water hickory, nutmeg hickory, and bitternut hickory.

Pecan, water hickory, and nutmeg hickory grow principally in the river bottoms of the lower Mississippi Valley and Gulf regions, whereas bitternut hickory occurs in nearly all of the eastern United States.

The botanical range of pecan (fig. 1–A) extends from northern Indiana south to the Gulf coast of Louisiana and Texas, and from western Tennessee and western Alabama west to eastern Kansas and central Texas. Pecan occurs locally in southwestern Ohio, Kentucky, Alabama, and central Mexico. The greatest commercial production of pecan occurs in the lower Mississippi Valley and Gulf regions.[2] Pecan is most common on well-drained loam soils on riverfront ridges not subject to prolonged overflows. Pecan does not normally grow in pure stands, but is found mixed with sweetgum, American elm, water oak, persimmon, cottonwood, hackberry, and honeylocust. It is a major component of the sycamore-pecan-American elm forest type.

Water hickory is found in the low, wet flats of the Coastal Plain from southeastern Virginia to southern Florida, west to eastern Texas, and north in the Mississippi Valley to extreme southern Illinois (fig. 1–B). Water hickory grows best in the upper Mississippi River Valley and in stream bottoms in well-drained, moist, light-textured, alluvium-like soils. Because it can grow on poor sites where more desirable hardwoods cannot survive, the most extensive stands of water hickory occur on the poorly drained, heavy-clay flats of the lower Mississippi River Valley and its tributaries. Water hickory is frequently found in association with overcup oak to form the overcup oak-water hickory type. Other common associates are American elm, green ash, sugarberry, waterlocust, pecan, blackgum, honeylocust, and other bottomland oaks.

Nutmeg hickory has a very limited range and is the least important of the commercial pecans. It occurs (fig. 1–C) scattered through central Alabama, central Mississippi, and northern Louisiana to southeastern Oklahoma and eastern Texas. Nutmeg hickory is reported to be abundant near Selma, Ala., and in southern Arkansas, where it is very common on high second-bottom flats of the Mississippi flood plains. Nutmeg hickory also occurs scattered in eastern South Carolina on rich, moist sites. Some of the prominent tree associates of nutmeg hickory are white ash, shagbark hickory, shellbark hickory, bitternut hickory, Shumard oak, and black tupelo.

The most abundant and widely distributed species of the pecan hickory group is bitternut hickory. It is also the only pecan hickory which grows in commercial quantities in the northern States. The natural range of bitternut hickory (fig. 1–D) ex-

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[2] Numerous cultivated varieties of pecan are grown throughout the Southeastern and Southern United States for commercial production of the sweet-tasting pecan nut.

NOTE: This publication supersedes unnumbered publication *Pecan,* issued 1945.

tends from New Hampshire and southern Quebec, west to Minnesota, south to eastern Texas and northern Florida. Its greatest commercial production is centered in Illinois, Indiana, and Ohio, but it is fairly common from southern New England west to Iowa and from southern Michigan south to Kentucky. Bitternut does not grow in the mountains of northern New York or New England, and is not found at the higher elevations in the Appalachian Mountains.

Bitternut hickory is associated with a large number of species because it occupies a variety of sites throughout its geographic range. In the northern portion of its range, bitternut hickory is an important component of the white oak-red oak-hickory forest type. In the south it is a prominent species in the swamp chestnut oak-cherrybark oak type. Bitternut hickory is also an associate in the white oak forest type.

DESCRIPTION AND GROWTH

Forest grown trees in the pecan hickory group are generally medium sized and have straight trunks and medium-to-stout branches. The pecan hickories grow more rapidly than the true hickories, but not as rapidly as some of their fast-growing associates. Species in the pecan hickory group vary in tolerance but all respond well when released. Pecan hickories produce both male and female flowers on the same tree (monoecious) and reproduce readily from both seed and sprout.

The bark of the young pecan hickories is characteristically smooth and gray, and remains close and firm for many years. Bark on mature pecan trees is grayish-brown to brownish-gray, moderately thick, and usually broken into long, closely interlocked, narrow, rounded, scaly ridges separated by narrow fissures. The mature bark of water hickory is similar to that of pecan, except it is usually browner, with loose, shaggy, platy, less interlocked ridges. Mature bitternut bark is thin, pale, and very close, with shallow furrows and low, narrow, interlocking ridges (fig. 2).

The leaves and fruit of the pecan hickories are shown in figure 3 (A–D). The leaves of pecan and water hickory are compound, 12 to 20 inches long, with 9 to 17 sessile, or nearly sessile, lanceolate to oblanceolate, opposite leaflets. Nutmeg and bitternut hickory leaves are also compound, but are only 6 to 10 inches long with 7 to 11 sessile or nearly sessile, lanceolate to oblanceolate, opposite leaflets. The fruit of the pecan hickories is 1 to 2½ inches long and round to egg-shaped. It is covered by a

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Figure 2.—Pecan hickory bark.

hard husk $\frac{1}{16}$ to $\frac{1}{8}$ inch thick, which splits lengthwise along the seam of the husk. The meaty part of the nut of the four pecan hickory species is edible, and the pecan hickory nut is especially popular because of its sweet taste. The bitternut nut is so bitter that it is thought to be distasteful even to wildlife.

Pecan hickory seed production begins when the trees are about 20 years old, but optimum seed-bearing age is from 75 to 225 years. The trees bear fair-to-good crops almost every year, and a mature tree yields 2 to 3 bushels of nuts per year. The pecan seeds germinate in late April to early June and produce seedlings which are intolerant, but less so than cottonwood and willow. Mature pecan hickories will grow 110 to 140 feet in height and 2 to 4 feet in diameter. The largest living pecan hickory is reportedly 6.8 feet in diameter, 135 feet tall, and has a crown spread of 145 feet.

Water hickory trees 20 years old or about 8 inches in diameter will bear seed, but optimum seed-bearing age is from 40 to 75 years. Heavy seed crops are produced almost every year, and a healthy, vigorous tree will produce about 2 bushels of seed per year.

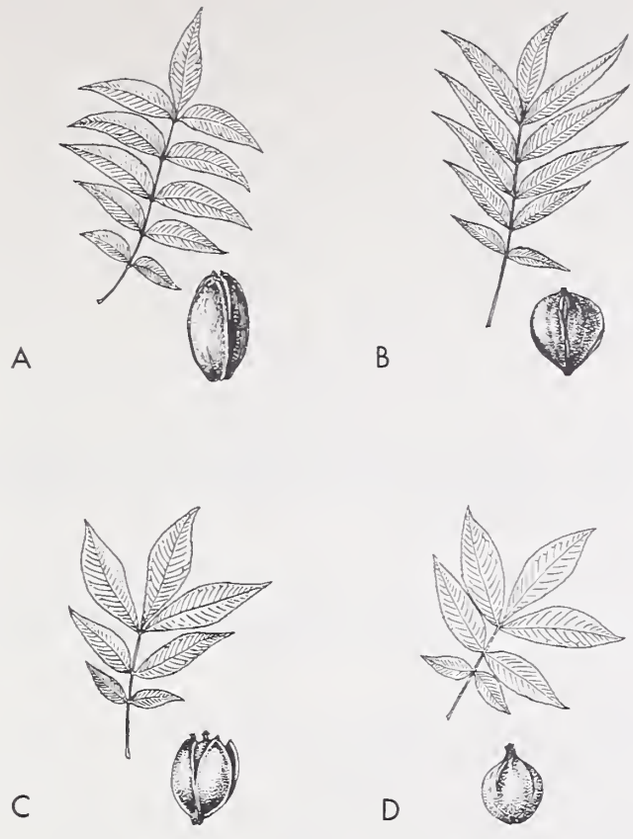

Figure 3.—Typical leaves and nuts of the pecan hickories—A, pecan; B, water hickory; C, nutmeg hickory; D, bitternut hickory.

Water hickory seedlings are intolerant and will not become established under shade, but dense stands develop in full light. Water hickory is rather slow-growing and can withstand considerable shade and competition after establishment. It has a longer dormant season than most species and can withstand late spring floods. Water hickory on a good site can grow to about 110 feet in height and 2 to 3 feet in diameter. The largest living water hickory recorded is about 7.1 feet in diameter, 150 feet tall, and has a crown spread of 87 feet.

The optimum seed-bearing age of nutmeg hickory is 50 to 125 years, but seed production has been reported on trees as young as 30 years old. Good seed crops are produced every 2 to 3 years. Nutmeg hickory is reported to be a slow-growing tree, attaining heights of 80 to 100 feet and often a diameter of 2 feet. Nutmeg hickory is considered a tolerant tree that will survive in the understory until released.

Bitternut hickory does not produce abundant seed until about 30 years of age. Good seed crops occur every 3 to 5 years, with light seed crops borne in the intervening years. Optimum seed production extends from 50 to 175 years. Trees over 175 years seldom produce good seed crops. Bitternut hickory seedlings are least susceptible to frost and more tolerant of a moist seedbed than are the other hickories. Bitternut hickory is a medium-sized tree that commonly attains a height of 70 to 100 feet and a diameter of 1 to 2 feet. The largest living bitternut reported is about 3.7 feet in diameter, 133 feet tall, and has a crown spread of 110 feet.

The pecan hickories are susceptible to fire damage at all ages, and even a light fire will kill all reproduction, including seedlings and small saplings. More intense burns wound large trees and thus provide entry for butt-rotting fungi. A number of insects attack the pecan hickories, but insect infestations rarely become epidemic or limit perpetuation of the species in any locality. The pecan hickories are resistant to damage from glaze storms.

COMMON NAMES

Pecan is the accepted common name for *Carya illinoensis*. Another common name frequently used is sweet pecan.

Water hickory is the accepted common name for *Carya aquatica*. Other common names are swamp hickory, pecan, bitter pecan, and wild pecan.

Nutmeg hickory is the accepted common name for *Carya myristicaeformis*. Swamp hickory, bitterwater hickory, and pecan are other common names for nutmeg hickory.

Bitternut hickory is the accepted common name for *Carya cordiformis*. This species is also known as pignut hickory, pecan, and swamp hickory.

RELATED COMMERCIAL SPECIES

The silvicultural characteristics, wood characteristics, and general appearance of the pecan hickories and true hickories are similar and the two groups are closely related. Bitternut hickory is especially similar to the true hickories in habitat and distribution. The distinction between pecan and true hickories is made in some timber inventories, but the current published timber volume reports do not categorize hickory by species groups.

In the wood industry, the two are mixed and sold under each other's group name. Once the wood is processed into lumber, it cannot be distinguished by species, based on physical appearance alone. Under low magnification, however, a distinction can be made based on anatomical structure, but this

is not a common commercial practice. Recent lumber production surveys have recognized this situation and combined the production figures for pecan and true hickory. Thus, any discussion of the lumber production or timber supply of one group cannot be considered without considering the other.

SUPPLY

The total supply of hickory sawtimber (pecan and true hickory species combined) was estimated to be 28.5 billion board feet in 1963. About 59 percent of the total volume is growing in the Southern and Southeastern United States. The majority of the remaining sawtimber volume is found in the north-central and Middle Atlantic States. In these areas, pecan and true hickory species make up 6 to 10 percent of the total growing stock of hardwood timber.

Kentucky contains more hickory sawtimber than any other State, 3.1 billion board feet or 11 percent of the total supply. Louisiana ranks next with 2.9 billion board feet, chiefly pecan and water hickory growing in the bottomlands of the Mississippi River. West Virginia ranks third with 2.6 billion board feet. Together these states contain over 30 percent of the supply. Other states with over a billion board feet include Indiana, Ohio, North Carolina, Virginia, Georgia, Alabama, Tennessee, and Arkansas.

In 1963, 47 percent of the hickory sawtimber supply was 11.0 to 14.9 inches in diameter, 30 percent was 15.0 to 18.9 inches, and 23 percent was 19.0 inches or larger. Forest Survey figures show that less than half the annual hickory volume grown each year is harvested.

PRODUCTION

Data on pecan hickory lumber production was first reported in 1913 when 1.1 million board feet was produced in 9 States (fig. 4). Production from 1914 to 1940 varied from a minimum of 140,000 board feet in 1916 to about 11 million board feet in 1940. During World War II the production of pecan lumber increased to 38 million board feet in 1942 and then decreased after the war.

Since the late 1940's, production has increased steadily from 11 million board feet in 1948 to about 85.6 million board feet in 1960. Figure 4 indicates that pecan lumber production increased significantly from 1960 to 1965, but the 145.8 million board feet shown is the combined total for pecan and true

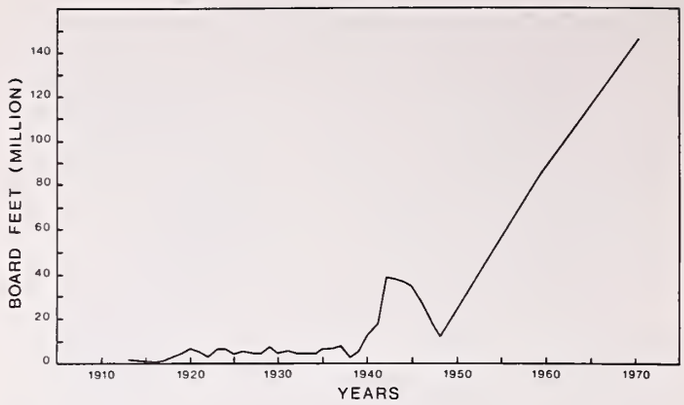

Figure 4. – Lumber production of pecan hickories (pecan, water, bitternut, and nutmeg), 1913–1965. Note: Production figures for 1965 include an undetermined amount of true hickory.

hickory lumber production. If the 1960 production figures are projected to 1965, about 61 percent or 88.9 million board feet of the 1965 production figure was pecan hickory.

Pecan hickory veneer production has increased significantly during the past 25 years. For example, since 1948 the production of pecan veneer has increased from less than 0.5 million square feet surface measure to over 102 million square feet surface measure in 1965. The volume of pecan and true hickory bolts used in manufacturing industries has increased from 39.6 million board feet (lumber equivalent) in 1948 to 63.9 million board feet (lumber equivalent) in 1960. In 1965 the volume of hickory bolts used decreased to 62.9 square feet (lumber equivalent). Based on the 1960 production figures, the last year pecan and true hickories were reported separately; only 2 to 4 percent of the hickory bolts produced were cut from the pecan hickories.

CHARACTERISTICS AND PROPERTIES

The heartwood of the pecan hickories is pale brown to reddish brown and the sapwood is white, sometimes tinged with brown. A considerable portion of the cross-section of younger trees is made up of sapwood, whereas in older trees a decreasing portion of the cross-section is sapwood. The wood has no characteristic odor or taste and is straight grained. The growth rings are distinct, and the springwood pores large and visible with the naked eye. The transition between springwood and summerwood in the pecan hickories is more or less gradual; under low magnification, fine white tangential lines (parenchyma) can be seen between

the large pores of the springwood in the pecan hickories, whereas in the true hickories these lines are absent between the large pores. This is the only true method of separating pecan wood from true hickory wood.

The wood of the pecan hickories is rated as strong, stiff, very hard, heavy, and very high in shock resistance. It is rated below the wood of the true hickories, but somewhat above white oak, sugar maple, and white ash in strength and other mechanical properties, especially shock-resisting ability. The wood of the pecan hickories is dense, having an average specific gravity of 0.59, but is not as dense as the wood of the true hickories which have an average specific gravity of 0.64. Lumber cut from the hickory is difficult to season without shrinking, warping, and checking, but when proper procedures are followed, it can be dried successfully. True hickory lumber is slightly more difficult to dry and shrinks more than lumber cut from pecan hickories.

The wood of the pecan and true hickories is rated as very difficult to work with handtools and difficult to work with machines. The pecan hickories, however, do machine slightly better than the true hickories. When rating the machinability of hardwoods based on number of good-to-excellent pieces resulting from a given operation, hickory rates above average in turning, boring, mortising, sanding, planing, and steam bending, but below average in shaping. In nail-holding ability, hickory is rated high, although it is classified along with sugar maple and birch as one of the woods most liable to split. To reduce this problem, it is suggested that slender, blunt-pointed, low carbon nails be used. Hickory can be glued satisfactorily, but requires very close control of gluing conditions to obtain best results.

Hickory lumber and veneer used in furniture manufacturing have good finishing qualities and have a warm, appealing appearance similar to walnut. However, painted hickory lumber exposed to the weather holds paint poorly, checks, cups, and tends to pull loose from fastenings. Hickory wood has a low resistance to decay and insect infestation and is regarded as a difficult wood to treat properly with preservatives.

The pecan hickories frequently have holes drilled through the bark by woodpeckers. These holes, or bird peck, result in discoloration of the wood, known as streaks. When they occur in moderation they have little effect on the mechanical properties of the wood, but they do affect its appearance and cause degrade or rejection of some lumber. Wind-and-frost shake are another defect commonly found in logs of the pecan hickories.

When the virgin hickory timber was being harvested, the heartwood, or red hickory, was often found to be less dense and thus not as strong as the sapwood. Because of this a negative attitude towards red hickory developed during the days of the virgin hickory stands. Tests by the Forest Products Laboratory have shown conclusively, that in the second-growth hickory stands of today, red, white, and mixed red-and-white hickory have the same strength characteristics and thus specifications and utilization practices should be adjusted to take this into account.

PRINCIPAL USES

The main use of the pecan hickories today is in the production of furniture. In 1965 approximately 57 percent of all hickory used in manufacturing industries went into furniture. This is a significant change in use compared to 30 to 40 years ago when 70 percent of the pecan hickory and almost all the true hickory used in manufacturing went into tool handles and framing and decking for the transportation industry.

Another important use of hickory today is in flooring. In 1965, 23 percent of all hickory used in manufacturing went into flooring and dimension stock. Pecan hickory veneer is produced for paneling and plywood containers, but the majority is used in manufacturing furniture. Some pecan lumber is also used for manufacturing pallets.

The pecan hickories are well suited for use in many specialty items because of their combined strength, hardness, and shock resistance. In the sporting goods industry, some pecan hickory is used for baseball bats, skis, and archery equipment.

The pecan hickories are used only to a limited extent for railroad crossties because of their tendency to split and check during drying and the difficulty in treating them with preservatives. The slow burning, high heating value, and hickory-smoked flavor of the pecan hickories have made them a popular fuel and charcoal-producing wood.

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